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Competition Dynamics Revisited

Wind Auctions in Germany and Spain

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D4.1-2, April 2022, Competition Dynamics Revisited: Wind Auctions in Germany and Spain

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1 Introduction

The popularity of wind power auctions has steeply increased in recent years. As this source of energy became competitive, governments around the world began to substitute feed-in tariffs systems with auctions. They introduced these to enable price discovery, enhance competition, and generally reduce the support renewables received through pre-existing support systems. As the AURES II project has shown, auctions were largely considered successful in inducing competition and reducing costs, but this paper looks to explore the implications of auctions beyond bid prices. We, the researchers, set out to explore how the introduction of auctions impacted the wind energy ecosystems of Germany and Spain. This paper seeks to go beyond a strong focus on auction outcomes and project developers. It is intrigued by the interdependencies between project developers, original equipment manufacturers (OEMs), landowners, financing institutions, other industrial players, and so on.

The rationale of the paper originated from an observation that while auction prices were declining – something which most welcomed – there seemed to be a number of problems in Europe's wind energy sector. German OEMs were in trouble, local opposition to wind farms increased, and project completion lagged behind schedule. Even auctions began to face troubles, as German authorities could not raise sufficient interest. We were curious about what was happening in a more broadly understood wind energy scene, given the vital importance of the sector to meeting climate targets. Wind Europe (2021) suggests that in-light of the European Commission's Fit-for-55 targets, the EU needs to increase its installed wind power capacities from 180 GW to 451 GW by 2030. This makes it especially pertinent to launch a discussion on the broader impact of auctions to explore how these goals can be reached in a sustainable manner. This paper is a mere point of departure for such a dialogue.

The paper assesses two cases alongside one-another: the German and the Spanish. The objective is not to conduct a rigorous comparative analysis in an academic sense, but rather to explore how competition impacted micro and macro dynamics in these two countries. That is, we explore how competition among a set of actors impacts those that are involved in that broader ecosystem. And, how these shape the sector at large and the broader national renewable energy landscape. Germany and Spain offer novel insights on the workings of the wind energy sector, given the sector's relative importance and maturity. Moreover, they both introduced wind power auctions and operate within the EU's framework. This also offers an opportunity to draw comparisons, which we will return to in the discussion section of the paper. Research began with a thorough literature review that looked at scholarship and the so-called grey literature (e.g. reports, policy papers, etc.), while also drawing on the findings of AURES II work packages. We then conducted interviews with actors that we identified as relevant in the wind energy ecosystem. We spoke to seven German and eight Spanish actor-affiliated experts between October 2021 and February 2022, which provided the data for our analysis (see Table 1 for an overview).

This paper is composed of three main sections, first the German case, followed by the Spanish case, and, finally, a discussion section and policy recommendations. Following this introduction and the analytical framework (section 2), the German case's section 3.1 begins with the wind energy landscape until auctions were introduced, with section 3.2 discussing the auctions and their impact. Section 3.3 moves to show how different actors were impacted by auctions and the context into which they were introduced, while section 3.4 draws conclusions for the German case. The paper then turns to Spain, where section 4.1 discusses early wind energy support in the country, while section 4.2 moves to the general suspension of these schemes. Section 4.3 discusses the introduction of auctions, while section 4.4 discusses how auctions impacted clusters of actors, before section 4.5 draws conclusions. The third main section of the paper turns to discussing the two cases and findings (section 5).

2 Analytical framework

Before moving to the cases, the following paragraphs offer a sketch of the analytical framework that helped structure our research. The decision of the German and Spanish authorities to introduce auctions in the wind sector is generally in-line with global trends (IRENA, 2019) to support further innovation and competition (Nordensvärd and Urban, 2015). Wind energy auctions have become a popular mechanism to distribute support for the diffusion of wind power generation, continuing the substantial – frequently unanticipated – reduction of bid prices (del Río and Linares, 2014; IRENA, 2019). They "represent a competitive and efficient form of procuring electricity" (Maurer and Barroso, 2011), which offers a tool for both price discovery and inducing competition between suppliers of energy.

The phenomenon we sought to map going into the project was: what were the reverberations of auctions? While these mechanisms have contributed to the reduction of electricity prices, scholars have identified some negative consequences as well. For instance, aggressive competition may drive *underbidding* that leads to declining realisation or implementation rates of projects (Gephart, Klessmann and Wigand, 2017; Haufe and Ehrhart, 2018; IRENA, 2019; Robinson and Keay, 2019). We aimed to take a step further back with our work to better understand the broader set of actors involved with the energy sector and how auctions impacted them and the relations they forge. Our work in the field suggested that actors within the sector have faced difficulties in recent years, which we initially hypothesised would be partly linked to the introduction of auctions.

Approaches to the wind energy sector, such as industry life-cycle theory, tend to focus on how technological change and forms of production shape the position of actors within the sector (Peltoniemi, 2011). While this is important, especially considering the declining costs of wind energy production, there are limitations to applying it. Wind energy is based on the diffusion of a "complex product" (Huenteler *et al.*, 2016), which does not necessarily scale the way many other products do nor does competition unfold as is suggested by an efficient market hypothesis. A complex technological artefact, such as an installed wind turbine, emerges as a result of the dynamic interplay between a number of social actors and their relation to their environment, constituting a socio-ecological system (Young *et al.*, 2006).

By taking a step back, we conceptualised those involved with wind energy to form an ecosystem. Actors interact with one-another and respond to a changing environment with political-economic interventions carrying rippling effects throughout the system. In this sense, our approach comes close to Braudel's (1996) ecological perspective (Hudson, 1987) and organisational ecology[1], whereby intertwined nodes – both physical and non-physical – constitute an ecosystem of relations. Interventions, such as a change in the subsidy support scheme introduced by a government (a node), have rippling effects on a broad number of actors engaged in the matter ranging from project developers through original equipment manufacturers to financing institutions.

[1] In a previous stage, different approaches which were deemed relevant for the analysis of this topic were revised and their suitability considered for the purposes of this paper. These included the industry life cycle (ILC) theory, organisational ecology, the theory of industrial organisation and the technological innovation systems (TIS) approach. The analytical framework includes some elements from these approaches. This review is available from the authors upon request.

3 The German case: it's all about the context

3.1 An evolving wind energy scene

Germany has sought to lead the energy transition quite early-on through actions, such as providing subsidies for renewables already in the 1990s. Supporting wind energy has been a key leg of the Federal Government's policies, which it backed by introducing legislation for feed-in-tariffs (FiT) with the "Electricity Feed-in Law" (*Stromeinspeisungsgesetz*, StrEG) in 1991 (Lema *et al.*, 2014). It continued its support with the "Renewable Energy Law" (*Erneuerbare–Energien–Gesetz*, EEG) in 2000. Both these measures were accompanied by streamlining building laws and other forms of support that it designed to enable the diffusion of wind power plants (Jobert, Laborgne and Mimler, 2007). The EEG was modified yet again to offer an administratively-set feed-in premium (FiP) as an alternative to the FiT to maintain the momentum of the sector (Leiren and Reimer, 2018). The number of installations took off in response to these policy interventions (Nordensvärd and Urban, 2015), particularly lifted by projects households, farmers, or smaller communities pursued (Wettengel, 2018). As an outcome, cumulative wind capacity increased threefold between 2000–2017 from just over 9 GW to nearly 29 GW (BWE, 2022).

Effectively all actors involved in the wind power ecosystem benefitted from the sectoral boom, banks, investors, landowners, OEMs, and project developers saw the sector's "golden period" (D_OEM1) until 2015–2016. The sector's lucrative returns – derived from the high FiT/FiP – attracted a number of investors ranging from small groups of farmers to large institutional investors (D_FIN2). Farmers became "small project developers", banks "saw these as safe investments", and "communities looked to attract wind power plants" (D_OEM1). Furthermore, the products of OEMs were in such high demand that they could choose which customers to service, as demand surpassed their available production capacities. Larger investors, including various *Stadtwerke* or utility conglomerates (e.g., RWE), entered the market as well. In the early-2010s, the sector began to mature, as actors involved, especially project developers, increased their know-how and contributed to "professionalization of the wind energy scene" (D_EXP2) in response to the rising complexity of obtaining permits. Federal legislation and credit made available by the *Kreditanstalt für Wiederaufbau* (KfW Bank) supported wind power, but resistance to its rapid ascent mounted through changes in regulations at the *Länder*-level.

Social resistance against wind power plants increased in the early-2010s, as locals sought to impede the construction of these large technological artefacts. Local regulations on the height of turbines was deemed an obstacle by the Global Wind Energy Council already in 2010 (GWEC, 2010), an issue that would sustain (GWEC, 2012). These would be combined with "administrative barriers and regulatory uncertainty [which] have also become issues. Technical and environmental regulatory issues, such as radar, rare species and turbine distance from housing, have delayed or brought projects to a standstill. Moreover, long planning procedures (3 to 5 years) along with the unclear situation regarding the design of the future support mechanism also cause uncertainty and unpredictability in the market" (GWEC, 2014, p. 51). The comments of multiple interviewees (D_EXP2; D_FIN1; D_EXP3) reflected that, indeed, administrative and environmental barriers mounted.

The "conflicts with environmental protection associations" (D_EXP3) became especially pronounced in the 2010s, as land suitable for projects became scarce. The not in my backyard (NIMBY) phenomenon became widespread (Hockenos, 2014) and resistance to wind energy generation capacities and related grid developments increased. These materialised in a number of forms, including *Länder*-level regulations, such as the 10H rule passed in Bavaria in 2014, requiring that installations be ten times as far from dwellings as is their height (e.g., a 200 m high wind turbine needs to be 2 km away from the nearest dwelling). Local resistance, however, pushed developers further into the countryside, where projects would interfere with wildlife in these areas to a larger extent (D_EXP3). Resistance was enhanced by "quite organised" (D_OEM1) civic mobilisation that would interfere and limit the ability of the sector to expand. Signals that the heightened competition for land would cause problems were becoming increasingly visible, as project developers faced difficulties in finding suitable locations and the strong demand for turbines was stunted (D_EXP2; D_OEM1).

3.2 A move to auctions

The German Parliament adopted EEG 2017 in July 2016, which substituted the administratively-set FiT/FiP for an auction system. The decision was partially prompted by the decline of wind energy costs, pressure from the EU to avoid market distorting state aid, and a gradual shift from the government to introduce competition enhancing measures in the sector (Leiren and Reimer, 2018). It was generally in-line with global trends (IRENA, 2019) to support further innovation and competition (Nordensvärd and Urban, 2015). In Germany, many presumed that this would re-couple subsidised and market prices, which the FiT/FiP system bifurcated. The EEG 2017 continued to support energy cooperatives, which had been the driving force of Germany's energy transition. They could "submit bids without having to obtain a [building] license beforehand and also granted them a longer implementation period – 54 months instead of 30 months" (Wehrmann, 2017). Cooperatives were also subject to a uniform pricing rule i.e., the awarded price they received was based on the highest winning bid. Thus, the government introduced a prompt to increase competition aimed to generate green electricity at lower prices, but in a way that favoured energy cooperatives.

The shift from a FiT/FiP to an auction scheme prompted project developers to "scramble" (D_EXP3) to propose and complete projects. They fast-tracked their plans to have them accepted in the existing system, which offered higher returns. A number of developers hurriedly submitted projects prior to the introduction of auction schemes to secure more lucrative returns. Momentarily, this boosted competition throughout the ecosystem, since a wave of projects led to higher demand for land, financing, and technology. The flood of projects extended into 2017, because those permitted before the end of 2017 could receive support under the FiT/FiP system, if finalised within 24 months (D_EXP3). However, the government adjusted the guaranteed price in this on a monthly basis to lower and lower levels during 2017. The uncertainty caused confusion and increased risks, leading project developers to focus on advanced projects to the detriment of others. This ruptured the continuity in the flow of projects, creating a "gap" (D_FIN1) between those near-completion and those in their planning stages.

Despite ample competition, high administratively-set prices and support could still compensate the climbing costs of projects. The regulator's 2017 auctions attracted sufficient interest, reflected in ample bid capacities and low prices (Lundberg, 2019), but was skewed by many larger project developers placing bids as part of energy communities — noted by all interviewees and see e.g. Grashof *et al.* (2020). That is, the terms of auctions were only appealing, if project developers also received the sort of support that regulations offered cooperatives. This led "[s]ome commercial project developers [to take] advantage of this regulation and set up the project development team such [a] way that they fulfilled all criteria for being a cooperative on the paper instead of being one in reality" (D_EXP3). For instance, UKA, Germany's second largest wind power project developer, was involved with the development of a number of energy cooperative projects (CEW, 2017).

On the face of it, the first auctions were successful, attracting both ample attention, reducing prices, and involving a large number of energy cooperatives, but, in practice, larger companies dominated auctions and competition was based on the regulatory loophole exploited by these actors. This allowed them to submit less developed projects, acquire longer realisation periods, and benefit from uniform pricing rules (the highest bid is offered to community projects). The placed bids became divorced from costs, since project developers adhered to a strategy whereby "[f]irst they could secure the bid, then if they win, they started to push OEMs to provide at such low prices [to] meet their price commitments" (D_OEM1). The prices submitted at auctions were not grounded in the input costs of wind power plants and *underbidding* became a pervasive response to auctions, potentially leading to declining realisation or implementation rates of projects (Gephart, Klessmann and Wigand, 2017; Haufe and Ehrhart, 2018; IRENA, 2019; Robinson and Keay, 2019).

3.3 The broader impact of auctions

3.3.1 Project developers

The regulator changed auction rules to address the energy communities-related issue, leading to a "lack of projects in recent years" (D_EXP3). As the favourable terms were withdrawn, developers responded by becoming much more cautious and less competitive in their auction participation. The relatively high bid-to-demand capacity ratios in 2017 plummeted in 2018. Administrative barriers became a mounting challenge that deterred actors from developing power plants, which materialised in submitted bids remaining below auctioned capacities, for instance, "in round 2018-4, bids were submitted for less than 60% of the auction volume" (Grashof *et al.*, 2020, p. 5). The impact of this would materialise in the limited capacity additions in subsequent years (BWE, 2022).

3.3.2 OEMs

The negative ramifications of underbidding rippled through the wind energy ecosystem. They carried especially harsh ramifications for OEMs, since their already low margins were further squeezed. Developers calculated what they could spend on turbines based on their bids, which was typically below both the short- and long-run costs of OEMs (D_OEM1), undermining the viability of their business. OEMs were forced to absorb losses and "German OEMs were hit harder by this than others, given local supply chain and high costs" (D_OEM1). This was exacerbated with the emergence of low-cost manufacturing that were able to increase their European market share during the 2010s. Chinese and other OEMs could outcompete German companies, due to their lower wage costs and the frequently suppressed prices of steel in China. Competition intensified paving the way for the "shake-out" (Klepper and Simons, 1996; Klepper, 1997) of European firms. Established large players could not out-innovate Asian firms that had much lower input costs.

The change carried ramifications throughout the wind energy ecosystem. OEMs not only faced tight margins coupled with high order volumes, as had been the case until 2017, but lower orders as well. Demand for the technology in the European market was not large enough for OEMs to remain competitive. And many were confronted with the implications of a strategic decision not to internationalise their operations and enter other markets. Even if some companies could have scaled their operations and benefit from economies of repetition (Davies and Brady, 2000) – Vestas was the only notable case – a number of OEMs (e.g. Enercon) went under or faced substantial financial hardship (D_OEM1). These received little support to maintain their operations, which otherwise kept jobs in the country and was considered a pillar of renewable energy-related industrial policy.

The innovation that would have been necessary to reduce prices does not necessarily occur in this sector in a continuous fashion, but rather in a cyclical or a non-continuous manner (Davies, 1997). Firms involved with manufacturing the rotor, power train, as well as mounting and encapsulation are able to streamline and make efficiency gains; thereby, reducing price, but this did not materialise during these tumultuous years. A contradiction emerged that there was a strategic ambition in Germany to become a provider of green technology, but the factors that supported competition between project developers led to "[t]oo much pressure on OEMs and the industry in general" (D_EXP1). An interviewee hypothesised that "[s]trategic cooperation between developers and OEMs [...unfolded as the] OEM market stabilised. Prices stabilised at the reduced rates" since 2018, but, in the interim, the lack of land and administrative barriers, exacerbated by the shift to the auction system, pressured the margins of OEMs.

3.3.3 Financial institutions

Historically, financial institutions saw wind power projects as stable forms of investment and, especially in the low interest rate environment of the 2010s, were pursued by a number of actors. Initially banks were the primary financiers of projects, taking an interest in the safe investments which they took on despite a general reluctance to "hold loans on their balance sheets for a long time" (D_FIN2). Equity and insurance firms had also entered these financial markets around 2014, intensifying competition (D_FIN2). The number of available projects collapsed after the shift to the auction schemes, which further increased competition between banks and shrank their margins. A handful of banks left the market and sought to invest in other areas (D_FIN1; D_FIN2), but the majority remained and continued to offer loans. The terms of these changed, as "[f]inancing shifted to [expect a] higher equity ratio [otherwise] Bankers would move onwards" (D_PRO1). Nonetheless, the large number of financing institutions that stayed in the market allowed "[b]igger project developers can go to up to ten banks and work closely with them" (D_PRO1). The newly emerging risk pertains to how this intense competition will be enhanced with the general risk of rising interest rates.

3.3.4 Other commercial actors

A key contextual factor shaping the price-signalling of auctions are the emergence of industrial actors that "can offer much more money for land than other investors" (D_EXP3), because their sole objective is to *green* their portfolio. Large industry players, ranging from BASF to Mercedes Benz, have taken a mentality where if it is green, they buy it. Their pivot is generally driven by ESG considerations, compliance to publish how they are addressing climate risks, and as a response to the political force to invest in green technologies. While their actions have supported the greening of their portfolios, their demand for projects has driven up the value of available projects as well.

3.3.5 Land owners

A key group of actors implicitly discussed throughout this section are the land owners, which have seemingly been the prime beneficiaries in monetary terms of the changes that emerged. During the initial years of the wind energy ecosystem's development land was sufficient to meet demand and there was little resistance to projects, since local communities were deeply involved in these endeavours. Land, as a bottleneck, emerged prior to auctions because "fierce competition" (D_PRO1) unfolded between project developers for land which is suitable for installations. This inflated prices, leading owners to see a "quite linear" increase in the value of their land, leaving them in a "comfortable position" with "stable" margins (D_PRO1). Such value has only increased with commercial interests (section 5.4) launching projects with a willingness to pay higher prices to green their portfolios. The rising issue in relation to this is not only providing sufficient land, which the government plans to address by allocating 2% of all land for the cause, but the rising opposition from locals and environmental groups to the construction of turbines in their vicinity (D_FIN1). Nonetheless, most interviewees expected land-related costs to continue to rise; albeit, the government's decision to allocate larger areas "would not reduce land prices, but maybe reduce the pace of growth" (D_PRO1).

3.4 Conclusions for the German case

The German case shows how a sector where competition is "overheating" can be negatively impacted by the introduction of an auction scheme. Under the FiT/FiP system investing in wind power was broadly seen as appealing, it offered stable returns and led to the development of an ecosystem with a healthy dose of competition. Project developers, OEMs, financing institutions, investors, landowners all competed in their respective fields. As the sector professionalised and consolidated in the 2010s, a key bottleneck, land, became a pervasive matter. Landowners benefitted from this but mounting local and civic resistance to projects led to intensifying competition among project developers, OEMs, financing institutions, and investors. Their margins generally declined, frequently jeopardising their operations. This was an especially pressing matter for OEMs, which faced heightened competition from low-cost manufacturers based in Asia. These contextual factors formed a kindling point, which a government decision to introduce auctions would spark. The shift to an auction system led all project developers to fast-track their existing projects, inducing further competition, leading to the misallocation of resources, rupturing project pipelines, and leading to the development of otherwise questionable projects. The haste and the lure of the returns derived from the FiT/FiP system were too appealing and rocked the wind ecosystem temporarily.

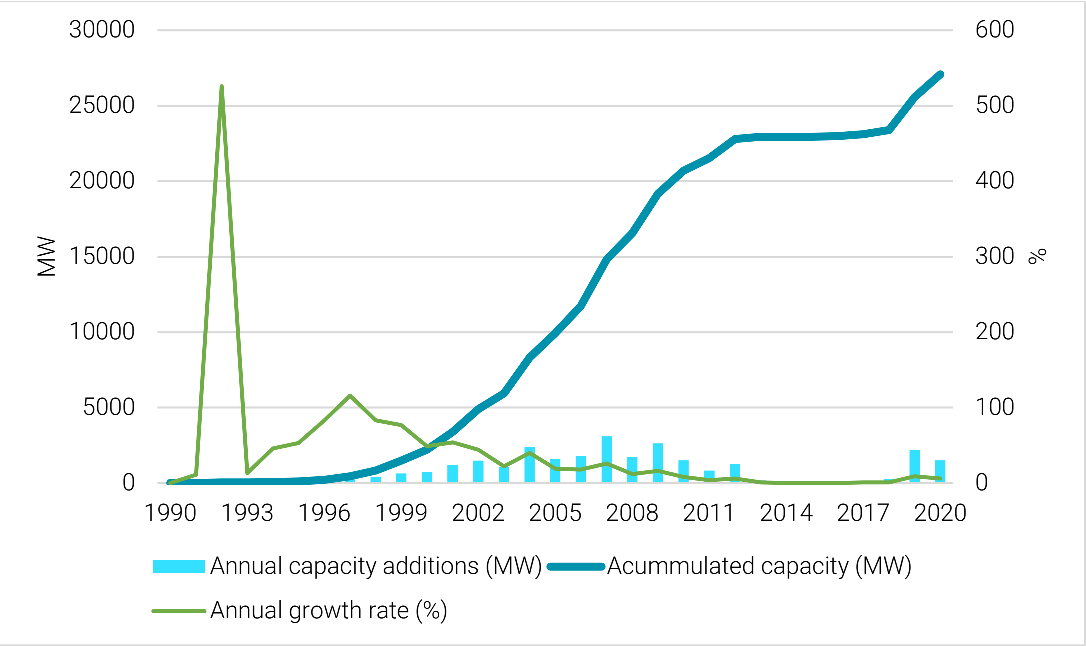
Government policy intended to support energy cooperatives through auctions, but larger actors that found loopholes to participate in such legal entities would further skew competition. They placed relatively aggressive bids, since they would not necessarily be compensated accordingly, but at a higher level. This, coupled with extended realisation periods, and the lack of permits in advance, led them to underbid. 2017 auctions results reflected a high interest due to these loopholes. Once the system was corrected, interest in auctions substantially declined. Bid capacities in 2018 did not add up to capacities auctioned off, which stripped the system of any competition. This was not in and of itself a consequence of auctions, but rather the combination of land-related shortages, administrative barriers, the backlog of projects proposed prior to the introduction of the auction scheme, and the specificities of the auction scheme. The impacts were, however, widespread, as they effectively destroyed the German wind turbine industry and accelerated the social resistance to wind power plants, given the flood of projects to enter the system without appropriate policy guiding their development.

4 The Spanish case: policy ups and downs

4.1 The initial golden years (1994–2009)

Spain has had policies to support wind energy deployment since 1994, under governments led by both conservative and social democratic parties. In 1998, the government introduced a formal remuneration scheme for renewable electricity with *Royal Decree 2818/1998*, which allowed generators to choose between a fixed feed-in premium (FiP) in addition to the electricity market price or a feed-in tariff (FiT) that offered a stable stream of revenue regardless of changes in the market price. The system was reformed in 2004 and 2007. The fixed FiP for wind effectively replaced the FiT in 2004 (since most generators chose the former)[2] and included a cap-and-floor system[3], attracting further investments (del Río, 2008). This period reflected considerable policy stability and moderate support levels – slightly above the generation costs of wind energy (see e.g. Ragwitz et al., 2007; Steinhilber et al., 2011). It triggered wind capacity additions (Figure 1) and facilitated the entry of firms into the sector. This market creation provided the basis for subsequent competition. In contrast to Germany or Denmark, where installations were mostly locally-owned by small owners, wind energy development in Spain mostly reflected a "large company" investors' model. This started with the participation of large corporations, including major utilities (AEE, 2004).

Figure 1: Evolution of installed capacity (MW)



Source: IDAE (2000) and IDAE (2001) for the 1990–2000 period. IRENA (2021) for the 2000–2020 period.

[2] Batlle et al (2012) suggest that the market risks associated with a FiP result in more barriers to entry for new RES-E developers and provide a competitive advantage to vertically integrated companies (e.g. generation and retail). Conventional generators may expand their portfolio by investing in RES-E technologies and thus gain market power by maintaining infra-marginal capacity.

[3] The FiP cap-and-floor price applied to installations participating in the market. If the market price plus the FiP climbed above the cap, RES-E generators would only receive remuneration equal to the cap's level. If they were below the floor, they would receive the floor price. Support increased significantly for the FiT (del Río, 2008) and the floor which was implemented for the FiP was very attractive for wind investors because it helped them access financing.

4.2 The dark side of the moon: the retroactive cuts and the moratorium (2010–2015)

Policy stability was a central feature of the Spanish system until 2009, but this changed thereafter. A pre-registry system was adopted for wind power projects. Those seeking subsidies had to provide several documents and a quota ("*cupo*") on the total amount of wind energy eligible for support between 2010-2012 – the system opened up 2,000 MW for each year. In order to be included in the registry, additional administrative requirements were imposed and a new monetary guarantee of EUR 20/kW had to be deposited. The government introduced several cost-containment measures, including a a cap on the generation which could be eligible for FiT support, a change in the tariff-updating mechanism (reducing remuneration levels) as well as a grid access and a generation charge. These would be exacerbated by a government moratorium on supporting new renewable energy capacity in January 2012, which extended until 2016. FiTs and FiPs were abolished and any new facility could only sell its electricity at wholesale market prices. These factors had a detrimental impact on the wind sector's expansion.

Existing measures were aggravated by a new regulatory package in 2013/2014[4]. The government took such action on the grounds that the previous favourable support scheme coupled with the reduction of technology costs led to deployment surpassing expectations, necessitating the alteration of the regulatory framework (BOE, 2014). The new framework was based on the concept of "reasonable profitability", which the government set at 7.39% in 2013 and would revise every six years (BOE, 2013). RES-E installations could participate in the electricity market to receive the wholesale price of electricity in addition to a "specific complementary remuneration", which was an additional subsidy provided for the investment and for the operation of plants.[5] Investors could not anticipate the value of the former, despite it being the more relevant of the two, because it depended on the parameters defined for each plant type and the length of the useful regulatory life. Furthermore, wholesale electricity price fluctuations prompted authorities to introduce "adjustment values": an upper and a lower threshold linked to the average annual electricity price on the daily market. If the electricity price moved above the upper limit, electricity generators had payment obligations, whilst if the price dipped below the lower bound, generators would receive corresponding monetary compensation.

According to the Spanish Wind Energy Association (AEE), the new regulatory package decreased monetary incentives by 41% on a MWh, excluding 6,323 MW of existing wind power from a support scheme (AEE 2020, p.22). That is, more than 300 wind power projects had to solely rely on revenues from the electricity market. Low and uncertain revenues, retroactive cuts, and the higher risks investors faced disincentivized new firms from entering the market, supporting the consolidation of the sector through mergers and acquisitions. The dynamics unfolding following the removal of subsidies resemble those in other countries (O'Sullivan, 2020). Ultimately, according to the OECD (2016), two key trends stood out in Spain during this period: (1) the utilities' ownership declined after 2014; and (2) institutional investors and venture capital funds played a greater role (OECD, 2016). Finally, conventional energy firms also entered the wind energy sector in recent years in response to the changes in the broader regulatory framework and the opportunities the sector presented.

4.3 The wind blows again: the introduction of auctions

The Spanish government introduced four renewable energy auctions since 2016 based on the 2013/2014 regulatory framework that focused on supporting the development of capacities. Two were technology-specific in January 2016 and were designed to support wind and biomass projects. These were followed by a technology-neutral auction in May 2017 and a multi-technology auction targeting wind and solar PV in July

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[4] The regulatory package was effectively based on four pieces of legislation: Royal Decree Law (RDL) 9/2013, Law 24/2013, Royal Decree 413/2014 and Ministerial Order IET/1045/2014. See del Río (2017) for an in-depth analysis of this regulatory package.

[5] The remuneration for the investment (R_{inv}) refers to a payment per kW that allows installations to recover those investment costs which cannot be recovered through the sales of electricity in the market. The specific remuneration for the operation (R_o) refers to a payment per kWh for those technologies whose operational costs are above the average wholesale electricity price.

2017. These supported a total of 3,607 MW of wind capacity – 500 MW in 2016, 2,979 MW in May 2017, and 1,128 MW in July 2017. Auctions awarded zero investment support (del Río, 2018), meaning that successful bidders opted to receive only the market price for generated electricity without any premium support.

Then, Spain adopted ambitious renewable energy deployment targets in its National Energy and Climate Plan (NECP).[6] This sets a 50 GW target for wind by 2030 (up from 28 GW in 2021), which the strategy envisions will mostly be met through auctions. These provide support for electricity generators through a long-term price for renewable electricity and the new system provides indication of auctions planned for the mid-term (a schedule). This is a marked shift to the auctions held in 2016 and 2017, which were organised on an ad hoc basis and provided support for capacities as opposed to generation (del Río and James, 2021). This design aims to provide an attractive regulatory framework for investors by ensuring predictability and certainty to facilitate the financing of the projects and enable the planning of investments within the entire supply chain (MITECO, 2020)[7].

The government has conducted two auctions within this new framework. The first one took place in January 2021, awarding 3,034 MW of total renewable energy capacity (including 1,000 MW of wind) to 32 bidders. It resulted in a weighted average price of EUR 25.31/MWh for onshore wind (MITECO, 2021). Seven bidders were awarded in wind, with one single firm capturing 62% of this awarded capacity. A second auction was conducted on October 2021, awarding a total volume of 3,124 MW at a higher weighted average price than in the previous round (EUR 30.18/MWh for wind). 17 bidders were granted 2,258 MW (72.3% of the total awarded volume) for onshore wind projects. There have been some problems related to grid access and permitting jeopardising the completion of some auction winning projects' on time. This links to the grid access backlog which emerged in 2019, despite the government introducing measures to address this, and the generally lengthy permitting procedures in Spain, whose length is also uneven across regions (IEA, 2021).

4.4 The impact of auctions on the competitive dynamics within the wind energy sector

Unlike in Germany, Spain did not shift from a FiT to an auction system, but it moved from the lack of any support scheme to an auction system. Thus, as stressed by several interviewees, the appropriate comparison is between auctions and the lack of any support rather than between auctions and administratively set FiTs or FiPs (ES_UTIL; ES_PRO1). The latter comparison is difficult to make, given that the technology costs in 2021 and 2007 are quite different (ES_UTIL), but also because the penetration of variable renewable energy technologies, the macroeconomic and institutional context, as well as the stringency of renewable targets (as set in the NECP) are different (ES_PRO1). However, the comparison seems unavoidable for most interviewees, given that the last support scheme before the auctions were administratively set FiTs/FiPs and that most of the current RES plants were built under the FiT/FiP.

The lack of a support system led actors in the wind energy ecosystem to welcome auctions in 2016 and 2021. They have been broadly understood to stimulate the sector (ES_FE1, ES_ASSO1) and facilitate access to financing (ES_UTIL). However, the tight deadlines assigned to projects within the auction system (3 years) (ES_PRO1) and the relatively high wholesale electricity prices in recent months have decreased their appeal, since these factors make merchant projects more attractive in the short-term. Furthermore, the effectiveness of the recent auctions to encourage the uptake of RES has been questioned due to concerns over prices awarded. This is particularly the case in the January 2021 auctions, which some deem to be too low in view of the subsequent strong increase in raw material prices and logistic costs (ES_FE1).

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6 *"PNIEC"* in its Spanish acronym.

7 For an in-depth analysis of the new Spanish auctions, see del Río and James (2021) and del Río (2021).

4.4.1 Project developers

Auctions offer a signal to project developers that can help encourage the uptake of renewables, but this is intertwined with other forces that shape the sector's growth, such as permitting. The latter has taken centre stage in Spain, where grid access permits have become a key bottleneck for project developers (ES_EXP1). For an expert affiliated with an association, "auctions do not set the path for renewable energy growth in Spain, but rather the permitting process does" (ES_ASSO1). However, the free transferability of rights to build the projects in auctions exacerbate the problems. According to some interviewees, bidders participate in auctions to obtain the right to build a certain capacity of renewable energy projects (without the need to identify those projects when they participate in the auction), which they can then sell to someone else rather than complete the project. An expert noted that "those that participate in the auction are not really the professionals in the sector, i.e. the developers, but 'permit getters'. In FiTs, developers came with pre-defined projects to get the premium" (ES_EXP1). This has encouraged the trading of building rights, leading some interviewees to voice their concerns that the transferability of projects led to speculation. As stressed by a utility affiliate "the 2016 and 2017 auctions resulted in a large percentage of projects that have been sold. It has been a bit of a speculative game, more financial than energy" (ES_UTIL).

Auctions allowed new actors to enter the sector, while the participation of large firms has been rather limited. According to an expert, "auctions have provided a signal for the whole sector that has allowed the incorporation of new actors (investment funds, institutional funds...)" (ES_EXP1), which was confirmed by an expert affiliated with an association, noting that "auctions have led to the entry of new players with different strategies" (ES_ASSO1). A financier remarked that "some of the awarded bidders in the first Spanish renewable energy auctions were relatively inexperienced and had limited available financial resources (equity) and little to no access to equity finance" (ES_FE1), introducing added risks in the completion of projects. The outcome of a higher number of participants has been strong competition and quite aggressive bids, as the awarded prices indicate. Meanwhile, the limited participation of large firms may be due to their involvement in other sectors, reduced profit margins, and their involvement in wind projects abroad (ES_ASSO1).

There is a widespread view that auctions increased competition and considerably reduced the profit margins of companies, both compared to the period prior to the introduction of auctions and merchant plants – the latter being linked to high wholesale electricity prices. Some interviewees were quite critical on the impact auctions inflict on the overall wind supply chain and, more broadly, the wind ecosystem. Association experts noted that "too much competition cuts the profit margins for the whole chain, negatively influencing other stages, such as the manufacturers, and causes local industry not to flourish (and/or to be destroyed)" (ES_ASSO1), while "auctioning creates a wilder context, with more competition" (ES_ASSO2). A project developer remarked that "the risk we see in the auction is that we put a lot of pressure on the whole value chain, and it may crack under that stress" (ES_PRO1). In response to intensifying competition, project developers and bidders balance projects included in the auction scheme and merchant plants in their portfolios. Some may opt to withdraw from the auction scheme before it concludes (since otherwise the generators would need to pay back additional revenues when high electricity market prices occur back to the system), an option they can exercise if the plant has already provided the "minimum energy of the auction". Afterwards, they can sell the electricity on the wholesale market[8].

Competition dynamics in the different frameworks are not only affected by the choice of instrument (e.g. auctions vs. FiTs or auctions vs. no support at all), but also by the design of the instrument itself. A schedule is particularly relevant in this context. The old auctions were announced on an ad hoc basis, while "[t]he schedule of the new auctions gives a signal to all actors in the value chain" (ES_ASSO1) allowing for actors to plan ahead. Similarly, an expert at a utility emphasised that "if there is no calendar, there will be distortions for manufacturers because no one will hire them. Rather than having an auction or not, the issue is that there should be visibility for investors and the value chain" (ES_UTIL).

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[8] When an installation reaches "minimum auction energy", it can withdraw from the auction support scheme (REER) and sell the electricity it generates on the wholesale market, receiving only this price. Without reaching the REER, the unit can be withdrawn from the scheme, but is obliged to pay a penalty (article 20 in Royal Decree 960/2020). See del Río and James (2021) for further details.

4.4.2 OEMs

OEMs do not directly participate in auctions, but are indirectly affected through their relationship with project developers and their central role in the wind energy ecosystem. The impact of auctions on their activities has had similar effects when compared to FiTs (past) and merchant plants (present); although, the intensification of competition and thinner profit margins led project developers to squeeze OEM margins to a greater extent in response to the auction system. This was captured by an association-affiliated expert, claiming that "[i]n administratively-set FiTs (ASFiTs), there was not so much pressure for OEMs to sell cheaply and therefore prices were high. With ASFiTs, the relationship between OEMs and project developers (PDs) was dominated by the OEMs. With auctions, things change, the pressure on PDs as a consequence of low auction prices is transmitted to OEMs, which are then required to sell to PDs at low prices" (ES_ASSO2). Another interviewee confirmed this, noting that "with FiTs, the bargaining power was with the OEMs, whereas now the OEMs are exposed to the bids resulting from the auctions, which strongly squeeze their profit margins" (ES_PRO1).

Auctions were in general welcomed by the sector (and, particularly, project developers and equipment manufacturers), since they provide a price floor which facilitates financing and encourages renewable energy uptake. However, the very low prices in the January 2021 auction which squeezed developers' profit margins when compared to those developing merchant plants "led to an adaptation for all actors in the sector, including OEMs" (ES_UTIL). This adaptation strategy may be based on the combination of merchant plants and those included in auctions, which provides developers and OEMs some flexibility to cope with tight margins, easing tensions in the supply chain[9]. This eases tensions in the supply chain[10].

4.4.3 Financing and banks

Auctions have increased the appetite of Spanish banks to finance renewable energy projects. This is due to their perception that auctions reduce price risk exposure, as compared to similar projects which operate under power purchase agreements or merchant projects and have considerably higher exposure to fluctuations in electricity market prices (ES_ASSO1; ES_FE1). The interest of banks to invest in wind power projects has been shaped by the perceived risk levels of such investments, and shifts to and from debt finance to corporate finance can be observed. "Initially (i.e., during the initial FiT support years), risks were perceived to be high, interest rates were higher, and banks only provided debt finance when relatively high(er) levels of equity were committed by the project investors. Under the current and recent past system (i.e., the use of RES auctions), wind power investments tend to be corporate financed" (ES_PRO1). Despite the increasing relevance of corporate finance, bank debt finance is flowing into wind power projects. "There is substantial interest among financial and lending institutions to finance wind power projects in Spain. This is projected to remain so, in the context of the massive scale up of investment required, in the context of meeting the country's NECP goals, etc." (ES_FE1).

One can observe differences between the financing conditions under auctions and FiTs, with financing being easier to obtain in the latter case when compared to the former. After being awarded in a RES auction, some project developers have to then spend considerable time to raise funds to develop a project (and/or fund company needs) (ES_FE1). This is in marked contrast to projects included in a FiT scheme, "wherein project developers had to prove they (already) held substantial levels of equity finance, to have any chance to obtain (debt) finance support from banks. Some of the awarded bidders in the first Spanish RES auctions were very inexperienced and had limited available financial resources (equity) and little to no access to equity finance" (ES_FE1). Nevertheless, once their bid was confirmed as awarded within the auction itself, they were able to secure bank finance support. The level of interest of banks to finance wind power projects has also fluctuated as a result of the same factors that also affect project developers' and others' interest in a given sector and

[9] As commented by ES_ASSO2 "the combination of auctions and merchant for different parts of the project and the aforementioned possibility to leave the auction and sell in the electricity market once the 'minimum energy of the auction' has been achieved provides some flexibility to PDs to achieve higher profits, which leads to a lower pressure for OEMs, since PDs have more money to spend on equipment".

[10] Note that the very low prices in the January auction in 2021 conflicts with the increases in raw material prices, "such as copper, iron, steel and rare earths, which leads to a greater cost for OEMs, pushing up the prices of wind turbines" (ES_ASSO2).

market. Specifically, these include aspects such as "overall regulatory and macroeconomic stability, the ease of obtaining a grid connection, the speed and efficiency of the project licensing and permitting process, etc." (ES_FE1).

4.4.4 Land and its owners

Renewable energy projects (not only wind power projects) are significantly more lucrative for landowners than rents for the same land when used for agricultural production (ES_LAE1). "The fact that, more and more, project developers compete for and agree to land rental agreements with landowners, well in advance of having been awarded, tends to hint at land access being a sellers' market" (ES_LAE1)[11]. This stems from increased competition for land use, offering lucrative remuneration for landowners and driving a sellers' market. The extent and degree of competition to acquire land suitable for wind power projects is not considered to be markedly shaped by auctions *per se*. It is rather an outcome of the ambitious NECP targets, which lead to high auction volumes which, in turn, result in competition for land. This is seen as inevitable, irrespective of the regulatory and RES support framework.

Rising rents claimed by landowners create substantial tensions in parts of the country (ES_EXP1). The social acceptability of renewable energy projects has never been a main issue, but this may be changing lately "probably due to the concentration of projects in specific zones and the problems related to their processing and permitting" (ES_UTIL). An expert claims that "social acceptability will be one of the biggest issues (sector bottlenecks) in the future, together with the access and connection problems" (ES_PRO1). This confirms the IEA's position that "onshore wind and other large-scale projects are facing increasing social acceptance and land-use challenges" (IEA 2021, p. 92) in Spain. Although auctions themselves are not the cause of this emerging social acceptability problem, but rather the ambitious targets (ES_ASSO2; ES_PRO1), auction design can help reduce it. "One such approach may be [to] specifically hold auctions for projects that would be developed on degraded lands (i.e. lands that could not be used for agricultural production). These would include, for example, lands damaged by wildfires, landfill zones, areas affected by mining activities, etc." (ES_PRO1).

4.5 Conclusions for the Spanish case

Auctions have been an instrument welcomed by stakeholders in the Spanish wind energy ecosystem and are clearly regarded as necessary to achieve the ambitious renewable targets set in the NECP. They have encouraged the entry of new firms and there is some consensus that auctions have increased competition in comparison to the previous support scheme (administratively-set FiTs/FiPs). The overall perception of the interviewees is that auctions are a good complementary instrument to merchant projects and PPAs. Their implementation and design should address trade-offs and conflicts between auctions and these other schemes. Competition between project developers has substantially increased since auctions were adopted. Moreover, OEMs are far more exposed to price competition when compared to earlier periods (e.g. 1998–2007), when they held considerably more negotiating power over equipment prices. A number of different stakeholders stressed the lower profit margins that auctions lead to compared to past FiTs and FiPs, but even compared to current merchant plants. This carries negative reverberations by impacting innovation or the development of a local supply chain, for instance.

Even though the government introduced auctions to reduce investor risk following a period when no support scheme was in place, many see it as a less attractive option to selling electricity on the wholesale market given high wholesale prices. A design flaw may be the transferability of rights, which has led to a certain degree of speculation, wherein bidders compete to obtain project development rights before selling these to project developers. That being said, competition is not only shaped by the type of support scheme employed, but also by how it is designed and the context into which it is introduced and this applies to both auctions

[11] There are also practicalities involved, in that project developers want to avoid being awarded in an auction and then having to initiate and close a land access agreement (which could require an extended period of time), and which could result in the realisation of penalties for non-completion of the project within the auction rules" (ES_LAE1).

and administratively-set FiTs/FiPs. A solid indication of the sector's development is essential to ensure the success of auctions and, thus, the role of an auction schedule should be emphasized in the Spanish case. The wind power sector has welcomed the publication of a clear auction schedule through 2030, adding that such certainty ensures stability. Offsetting declining social acceptability can also be partly addressed through auction design; although, land access for wind power projects is not yet considered to be a major area of competition between project developers within auctions[12]. Other contextual factors may also play an important role in shaping the competition dynamics. In particular, project permitting (including grid permits) may negatively affect auction outcome – reducing its effectiveness through lower levels of participation, for example. There is a need for strong coordination between auctions and permitting procedures.

[12] IEA (2021) argues that "addressing these issues will require inclusive and transparent stakeholder consultation processes, along with allocating some benefits of the energy transition to local communities and ensuring minimal environmental disruptions. Planned new auction frameworks that include renewable energy communities will help in this regard. Co-ordination between regional governments and the central government will also be critical to ensuring local approval" (p. 92).

5 Discussion and policy recommendations

5.1 Discussion

This paper's inquiry was prompted by the underlying presumption that while auctions may have contributed to enhanced competition between project developers and the reduction of subsidies, they also carried wide-ranging negative ramifications throughout the wind energy ecosystems in both Germany and Spain. We have found that it was not necessarily the introduction of auction schemes that spurred unfavourable developments, but rather these policy instruments exacerbated pre-existing tendencies and issues. By exploring these dynamics, we have also been able to trace how auctions impacted not only project developers, but also OEMs, financing institutions, and land owners.

Germany and Spain offer two cases where wind energy has come to play a substantial role in the energy mix and their respective governments introduced auction schemes in recent years. Beyond this, there are a number of differences in their respective wind energy ecosystems and institutional contexts, which have shaped the path of the technology. Both countries had generous subsidy schemes in place to support the diffusion of the technology, but their governments decided to move to a system that allowed for price discovery and enhanced competition. The fixed forms of remuneration offered investors stable returns and allowed for a rapid diffusion of wind energy, but once these were suspended capacity additions either slowed down substantially or only continued because a large number of projects were submitted before the pre-existing scheme was closed. A substantial backlog of projects accumulated in Germany during the shift in subsidy schemes, which would fuel the sector's growth in ensuing years. This, however, led to a gap regarding the projects that were in the pipeline. The Spanish phase out of the feed-in tariff system occurred much earlier and capacities subsidised were gradually reduced, before the support system was suspended altogether.

Germany transitioned from a feed-in tariff scheme to an administratively-set feed-in premium scheme to an auction system, while Spain returned to supporting renewables through auctions after an interim period where no subsidies were available for plant owners. Project developers and the wind energy sector by-and-large welcomed the latter shift, since it provided backwind for a sector where growth was also suspended. Wind energy costs may have declined during the second half of the 2010s, but they were not yet competitive on a market basis in either country. This is changing, which also reframes the purpose of auctions. In Spain, they have become the (dominant) part of a broader portfolio, a tool to mitigate risks, since they balance merchant plants, which can also be competitive, especially in the recent high energy price environment. In Germany, interest towards these waned as their attractiveness declined, once more stringent measures to avoid underbidding through cooperatives was introduced by the regulator. Both cases show that auctions, coupled with shortages in land or grid access may drive speculation. In the German case this was mostly for permits when energy cooperatives were defined in a manner that companies could exploit, while in Spain it links to the transferability of rights and permitting, with auction-approved projects offering a potentially stable investment that has driven speculation among investors.

In principle, auctions negatively impacted project developers, but both cases show that they were able to partly shift this burden to other actors within the ecosystem. Their profit margins may have somewhat declined, but not necessarily as much as others'. OEMs were especially negatively affected by these changes. After years of stable revenues, healthy margins, and a market where they had difficulties in meeting demand, the competitive dynamics exacerbated by auctions jeopardised their operations. The efficiency gains technology providers could reach were not on par with the pressure to reduce prices and the newly emerging competition from Asian suppliers. As a "complex product", wind energy technology providers could not scale and achieve efficiency gains that would maintain their competitiveness. This would have an especially adverse impact in Germany, where a sizable wind OEM sector had emerged but was now facing financial hardship. These firms delivered products while booking losses in the short-term and only presuming that their margins will stabilise in the long-term. In many cases this never came to be.

The prime bottleneck in both countries relates to access. This is access to land in the German case, while access to the grid in the Spanish. Land available for new installations has been a prevalent issue in Germany for years. Resistance from locals to develop wind farms in their vicinity and opposition from environmental groups limits the areas where turbines can be installed. The rising costs of land were a problem irrespective of the support system in-place, but as the wave of projects developers submitted under the feed-in auction scheme materialised, the matter worsened. As accumulated capacity increased, the issue's prominence grew, while it also benefitted land owners who could charge higher and higher prices for their acreage. In monetary terms, they were the winners as events unfolded. In Spain, land is also becoming a problem, since the concentration of generation capacities in certain areas has spurred social resistance to additional plants. This limits the area that can be utilised for wind projects, which also drives up land prices. Here too, land owners are beneficiaries of these dynamics, which generally provide them with better returns than maintaining agricultural activities, for instance. Auctions did not play a particularly central role in causing these dynamics, they were forces that had been in place. Suitable and available land declined as accumulative wind capacities increased, mostly driven by ambitious renewable energy targets.

As the economic competitiveness of wind energy rose, access to the grid became a rising issue especially in Spain. The combination of land scarcity and the limitations in the grid's capacity are closely linked to an increasingly acknowledged problem that administrative barriers pose a big hindrance to further renewable diffusion. This, yet again, in both cases is not a direct result of auctions, but is rather a looming problem that was exacerbated by contextual factors and auctions. Its rippling effects have weighed on project developers, OEMs, and, to some extent financial institutions as well. The latter vital cluster of actors has also seen its profit margins sink as competition increased in these two countries. They were not quite as adversely impacted as OEMs, but were forced to adapt to a changing environment, forcing some out of the market. Simultaneously, auctions have also attracted additional financing institutions, mostly non-banks, that are looking for long-term stable investments. Winners of auction bids offer relatively lower yields but at lower risks compared to merchant plants as the Spanish case illustrates, for instance. Moreover, in Germany commercial enterprises have also taken to wind energy investments, which further increases electricity prices, since, in these cases, their objective is to green their portfolio as opposed to ensure the lowest cost electricity. The large industrial base of Germany makes this a set of actors to closely monitor, since their investments can further intensify competition within the sector.

The German and the Spanish cases show that auctions are largely welcomed by actors from within the wind energy ecosystem, but how they are introduced, how they are designed and to which context is an essential consideration for their success. Abrupt shifts in policy frameworks destabilise relations between actors. This, frequently, leads to huge pressure on certain actors, shrinking margins and forcing many to exit the market. Enhanced competition tends to take a particularly strong toll on OEMs. This may in and of itself not only be a result of auctions, but is closely linked to them: they enhance competition which leads project developers to pressure OEMs. However, the latter may not be able to reduce costs at the pace necessary to maintain competitiveness with foreign suppliers and may also have to brace themselves for volatile orders during the transition in policy frameworks. On the face of it, land owners have gained the most from added competition, since their acreage is in such high demand that they simply need to wait for project developers to outbid one-another for lots. This, however, can cause further tension as installations are pushed into areas where social resistance may mount due to these bordering protected areas or jeopardising the well-being of marginal communities, for instance. These cases have shown that auctions are tools that help price discovery and induce competition, but their ramifications ripple through a broader ecosystem leading to further competition and other outcomes that may clash with other social objectives.

5.2 Policy recommendations

The two cases explored in this paper offer a number of policy lessons. In the case of Germany:

- The German case indicates that land is a substantial barrier to the diffusion of renewable technologies. The recently appointed German government has sought to address this by discussing how to allocate 2% of the country's land to renewable energy. This is a necessary objective but identifying which land can be used for such purposes is an inherently political and pressing matter. This should be done with the engagement of locals to avoid resistance.
- Second, if Germany is to become a leader in renewables and seeks to maintain a domestic industry than it must consider the broader implications of project development and competition induced by auctions and other factors. German OEMs have struggled, despite their objective to provide local

green jobs. Government policy should support these endeavours, because, as the COVID-19 pandemic has shown, various events can disrupt supply chains, but this cannot be to the detriment of renewable diffusion if Germany is to achieve its renewable targets. Moreover, the recent high costs of shipping — linked to higher energy prices and shortages in cargo carrying capacity — may have even made it more profitable to produce in Germany than rely on imports. Thus, a security and an economic argument suggest that supporting the domestic industry is worthwhile.

- A third policy implication is that auctions need to be introduced in a transparent manner and signalled well in advance. To avoid the flood of projects that skewed the wind energy scene between 2016-2018, governments should consider managing the transition from FiTs/FiP to auction through extensive consultations, active communication, well in advance, and by developing plans and strategies that avoid a glut of projects.
- Fourth, and finally, governments need to consider the specific criteria of auctions carefully and develop requirements that lead project developers to only propose viable projects and do not try to benefit from regulatory loopholes.

In the case of Spain:

- Consider developing guidance to minimise tensions between competing land uses (namely, agricultural versus wind power). This may include reviewing the options and feasibility of promoting wind power projects on degraded land sites.
- Ensure that auctions continue to promote overall stability in the sector. Healthy levels of competition are not simply reliant on an auction system, but broader macroeconomic and regulatory stability. Policy-makers should continuously review whether the specific auction design element "settings" (e.g. project non-realisation penalties) are the optimal.
- Bear in mind that auction-induced high levels of price competition that pressure OEMs can negatively impact these firms' innovation and also the local industry value chain. Whilst price competition carries the potential to stimulate cost efficiency gains, the ability of OEMs to realise technology improvements is also shaped by their access to finance to invest in R&D efforts. If prices are overly pressured and margins dissipate, OEMs' ability to innovate may dissipate since their sole focus is to survive.
- Closely monitor how awarded bids are resold and the levels of speculation for project development rights. Particular focus should be placed on tracking project realisation rates and compliance with project development deadlines. There are substantial concerns among market actors and industry observers whether those that were awarded low price bids will be able to develop and operate financially sustainable projects.
- Finally, a closer coordination between auction procedures and administrative procedures (for permitting and grid access) should take place.

More general policy recommendations:

- Policy-makers at the national and EU-level should consider the relation between energy and industrial policy in greater depth. If the EU seeks to maintain a resilient and leading green tech sector then there may be a need to support actors involved in this ecosystem, such as wind OEMs. Exploring the relation between auctions, subsidies, and free market principles is a worthwhile departure. However, governments and regulatory authorities can substantially support these actors by clearly indicating expected capacity additions to allow for them to plan ahead, develop production capacities, and innovation according to expected demand.
- A stable and predictable framework is essential. Shifts in support schemes should be very gradual and the interim steps ought to be clearly indicated.
- Auctions and other policy tools need to be designed in a circumspect manner that anticipates and identifies potential issues in their nascency. Accordingly, matters such as available land or grid connection capacity should be addressed in parallel to the development of support schemes and protocols to coordinate the different procedures should be developed.
- Introduce measures that limit the ability of developers and other actors to speculate, for example by limiting the transferability of rights.

6 Interviews

Table 1: Interviews

Interviewee's code	Position description	Initial interview date
D_OEM1	OEM executive until 2021	20.10.2021
D_EXP1	Expert at wind power association	06.12.2021
D_EXP2	Wind energy expert at think tank	13.12.2021
D_EXP3	Wind energy association expert	20.12.2021
D_PRO1	Senior executive at major wind project developer	10.11.2021
D_FIN1	Senior Executive at bank	21.12.2021
D_FIN2	Expert involved with the legal aspects of financing wind projects	17.11.2021
ES_EXP1	Wind energy expert at think tank	24.01.2022
ES_ASSO1	Expert at renewable power association	24.01.2022
ES_ASSO2	Expert at wind power association	25.01.2022
ES_LAE1	Land access expert for wind power projects	25.01.2022
ES_FE1	Finance expert for wind power projects	28.01.2022
ES_LUA1	Expert within a regional land use agency	03.02.2022
ES_UTIL	Expert at utility	09.02.2022
ES_PRO1	Senior executive at major wind project developer	16.02.2022

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AURES II is a European research project on auction designs for renewable energy support (RES) in the EU Member States.

The general objective of the project is to promote an effective use and efficient implementation of auctions for RES to improve the performance of electricity from renewable energy sources in Europe.

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